

AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning page 8, line 16 with the following rewritten paragraph:

The perovskite membrane for use in said processes must contain at least one element (I) whose valence is substantially mixed under said process conditions, and (II) with the additional requirement that the oxide of said element, or of any additional element of which the membrane is composed, does not reduce to a metal under any condition encompassed by said process conditions. This requirement points to the group of 3d transition metals, but with the limitation expressed by part (I) of the requirement excluding Sc, Ti, V, Cr, and Zn as the mixed valence element, and part (II) excluding Co, Ni, and Cu. Therefore, only Fe and Mn satisfy part (I) and part (II) of said requirement, and, hence, the membrane must contain Fe or Mn or mixture thereof. The membrane can not contain Co, Ni, or Cu. Therefore, the preferred compositions of US 5,712,220, referenced in the "Background of the invention", can not be used as membranes in the-said processes. Said preferred compositions of US 5,712,220 are expected to decompose under the conditions fo the said two processes, resulting in decreasingly poor oxygen permeation and eventually to cracking and complete breakdown of the membrane.

Please replace the paragraph beginning page 9, line 9, with the following rewritten paragraph:

Among the oxides of Ca, Sr, Ba, and La, the oxides of Sr and Ba are not sufficiently stable with respect to formation of carbonates, SrCO_3 and BaCO_3 , to be used in said processes for which typical process parameters were given in Tables 1 and 2. The stability of the oxides of Ca, Sr, Ba, and La relative to the corresponding carbonates are shown in Fig. 1. Hence, for said processes, only La and Ca can be used as A-cations in the perovskite of which the membrane consists. The exclusion of Sr and Ba as constituents of the membrane, excludes the use of the preferred compositions of US 5,712,220, US 5,306,411, and W097/41060, referenced in the "Background of the invention", as membranes in the-said processes. Said preferred compositions of US

5,712,220, US 5,306,411, and W097/41060, all containing Sr or Ba, are expected to react with CO_2 and decompose under the formation of SrCO_3 and BaCO_3 under the conditions of said two processes, resulting in decreasingly poor oxygen permeation and eventually cracking and complete breakdown of the membrane.

Please replace the paragraph beginning page 10, line 15, with the following rewritten paragraph:

The exclusion of Ga and Cr excludes the use of the preferred compositions of US 5,306,411 and W097/41060, referenced in the "Background of the invention", as membranes in the said processes. Said preferred compositions of US 5,306,411 containing Cr, are expected to become depleted in Cr as $\text{CrO}_3(g)$ evaporates from the surface of the membrane under the conditions of the said two processes, resulting in decomposition of the membrane material and the formation of new compounds, which yields decreasingly poor oxygen permeation and eventually cracking and complete breakdown of the membrane.

Please replace the paragraph beginning page 12, line 23, with the following rewritten paragraph:

The exclusion of stoichiometric and A-site deficient perovskites, excludes the use of the compositions of US 5,712,220 and W097/41060, and excludes the use of the preferred compositions of US 5,306,411 referenced in the "Background of the invention", as membranes in the said processes. Said compositions of US 5,712,220, US 5,306,411, and W097/41060, are expected to decompose in the large oxygen partial pressure gradient of said two processes, resulting in decreasingly poor oxygen permeation and eventually to cracking and complete breakdown of the membrane.

Please replace the paragraph beginning page 13, line 1, with the following rewritten paragraph:

Compositions represented by said formula, and where the numbers v and w are selected such that v = 1 and $0.95 \leq w < 1$, however, are stable with respect to kinetic decomposition even in oxygen partial pressure gradients of well above 10 decades. Under certain additional requirements regarding the values of x and y of the enumerated formula, said compositions are characterized by stable oxygen flux not decreasing with time, and single phase unchanged membrane surfaces and interior. Examples of the performance of such compositions are presented in the present Examples 11, 13, and 14 and Figures 3, 5, 6, and 7.

Please replace the paragraph beginning page 14, line 14, with the following rewritten paragraph:

Compositions represented by said formula, and where the numbers x and y are selected such that $(x-y) > 0.3$, are not simple perovskites at conditions representative of the said processes. The cations and oxygen vacancies of these compositions become ordered, during which ordering process the flux rates decrease to eventually reach too low permeation rates to be used as membranes in said processes. An example of the low oxygen flux of these compositions is provided in the present Example 25.

Please delete the paragraph beginning page 17, line 24:

EXAMPLE 1

PREPARATION OF $\text{La}_{0.4}\text{Ca}_{0.6}\text{Fe}_{0.485}\text{Ti}_{0.485}\text{O}_{3-\delta}$

A solid mixed conducting membrane was prepared by a soft chemistry route wherein the appropriate amounts of La_2O_3 , CaCO_3 , and titanyl acetylacetone were first dissolved in nitric acid. To this liquid mixture was added the appropriate amount of a prepared standardized 1M aqueous solution of $\text{Fe}(\text{NO}_3)_3$. The

Please replace the paragraph beginning page 18, line 3, with the following rewritten paragraph:

A solid mixed conducting membrane was prepared by a soft chemistry route wherein the appropriate amounts of La_2O_3 , CaCO_3 , and titanyl acetylacetone were first dissolved in nitric acid. To this liquid mixture was added the appropriate amount of a preprepared standardized 1M aqueous solution of $\text{Fe}(\text{NO}_3)_3$. To the~~The~~ mixture was added citric acid in excess, and excess water was evaporated for 3 hours at 90°C, during which time complexation takes place. The resulting gel was pyrolyzed in air for 14 hours by heating to 140°C, whereupon the resulting dry powder was calcined at 500°C for 2 hours and 900°C for 10 hours. The powder mixture was then combined with a binder and uniaxially cold pressed to a 13 mmØ disk at 180 MPa. The resulting porous disk was heated to 500°C at 5°/min to allow controlled combustion of the binder, and then further heated to 1250°C, maintained at 1250°C for 3 hours and cooled to room temperature. This procedure yielded a 10 mmØ gas tight disk with >96% of theoretical density. The membrane was polished on both sides to a 1 micron surface finish and 1.66 mm thickness. The formula representing the product may be expressed as $\text{La}_{0.4}\text{Ca}_{0.6}\text{Fe}_{0.485}\text{Ti}_{0.485}\text{O}_{3-\text{d}}$.

Please replace the paragraph beginning page 19, line 3, with the following rewritten paragraph:

A solid mixed conducting membrane was prepared by a soft chemistry route wherein the appropriate amounts of La_2O_3 and $\text{Sr}(\text{NO}_3)_2$ were first dissolved in nitric acid. To this liquid mixture was added the appropriate amounts of preprepared standardized 1M aqueous solutions of $\text{Fe}(\text{NO}_3)_3$, $\text{Cr}(\text{NO}_3)_3$, and $\text{Co}(\text{NO}_3)_2$. To the~~The~~ mixture was added citric acid in excess, and excess water was evaporated for 3 hours at 90°C, during which time complexation takes place. The resulting gel was pyrolyzed in air for 14 hours by heating to 140°C, whereupon the resulting dry powder was calcined at 500°C for 2 hours and 900°C for 10 hours. The powder mixture was then combined with a binder and uniaxially cold pressed to a 13 mmØ disk at 180 MPa. The resulting porous disk was heated to 500°C at 5°/min to allow controlled combustion of the binder, and then further heated to 1200°C, maintained at 1200°C for 3 hours and cooled to room temperature. This procedure yielded a 10 mmØ gas tight disk with >96% of theoretical density.

The membrane was polished on both sides to a 1 micron surface finish and 1.5 mm thickness.

The formula representing the product may be expressed as $\text{La}_{0.2}\text{Sr}_{0.8}\text{Fe}_{0.8}\text{Cr}_{0.1}\text{C}_{0.1}\text{O}_{3-\text{d}}$.

Please insert the following paragraph after the paragraph beginning page 19, line 21:

EXAMPLE 5

PREPARATION OF $\text{La}_{0.3}\text{Ca}_{0.7}\text{Fe}_{0.485}\text{Ti}_{0.485}\text{O}_{3-\text{d}}$

A solid mixed conducting membrane was prepared according to the method of Example 1 except the amounts of the reactants were chosen to yield a product that may be represented by the formula $\text{La}_{0.3}\text{Ca}_{0.7}\text{Fe}_{0.485}\text{Ti}_{0.485}\text{O}_{3-\text{d}}$. The membrane was polished on both sides to a 1 micron surface finish and 1.46mm thickness.